Regional Congress on Root and Tuber Crops for Food Security and Climate Change Resilience in Asia

Proceedings

October 17-18, 2019 | Luxent Hotel, Quezon City, Philippines

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ACRONYMS

ABS	Aqua-based Business School
AR4D	Agricultural Research for Development
ASEAN	Association of South East Asian Nations
BSU	Benguet State University
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CIAT	International Center for Tropical Agriculture
CIP	International Potato Center
DA	Department of Agriculture
DOST	Department of Science and Technology
EC	European Commission
FAO	Food and Agriculture Organization of the United Nations
FBS	Farmer Business School
FFS	Farmer Field School
FO	Farmers Organization
FoodSTART+	Food Resilience Through Root and Tuber Crops in Upland and Coastal Communities of the Asia-Pacific
GAP	Good Agricultural Practice
GMP	Good Manufacturing Practices
KLF	Knowledge and Learning Fair
IEC	Information, education and communication
IFAD	International Fund for Agricultural Development
IMOD	Inclusive Market-Oriented Development
IIRR	International Institute of Rural Reconstruction
ISP	Industry Strategic S&T Program
LGU	Local Government Unit
OFSP	Orange fleshed sweetpotato

PCAARRD	Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development
POT	Package of Technology
R&D	Research and Development
RCP	Representative Concentration Pathways
RMT	Rapid Multiplication Technique
RTB	CGIAR Research Program on Roots, Tubers and Bananas
RTC	Root and tuber crop
S&T	Science and Technology
SEARCA	Southeast Asian Regional Center for Graduate Study and Research in Agriculture
TAU	Tarlac Agricultural University
TC	Tissue Culture
TOT	Training of Trainers
VNUA	Vietnam National University of Agriculture
VSU	Visayas State University
WFP	World Food Programme

BACKGROUND

Root and tuber crops (RTCs) have been gaining recognition as nutrient rich food crops, versatile raw material for MSEs and agri-industry (i.e. food, feeds, starch, bio-ethanol), and instrumental to enhance resilience to climate change. They grow in a wide range of environments, require lower input than grains and have exhibited evidence to addressing vulnerability and risks related to increasingly recurrent extreme weather events, particularly in the Asia and Pacific region. For instance, in the Philippines RTCs have been critically part of post-Haiyan typhoon's food relief and rehabilitation efforts where about 8M planting materials mostly of sweetpotato and cassava have been distributed to affected 65 municipalities in Leyte-Samar areas.

Despite their potential for enhancing food security, resilience, diets and income generation through value addition, RTCs still face major challenges in the region, including low productivity of smallholder farmers, pests and diseases, limited utilization and consumption, slow adoption of improved production and processing technologies, and lack of compliance to industry standards. Furthermore, these crops, despite being increasingly important in countries such as Vietnam, Cambodia, Laos, Myanmar, often receive limited attention by policy makers and donors, resulting in insufficient investments in R&D and technology dissemination. However, encouraging initiatives have emerged over the last decade funded by national budgets and the international donor community. For instance, the Government of Philippines is increasingly paying attention to RTCs and sweetpotato, cassava and taro are now part of the *Food Staple Sufficiency Program* of the country (DA, FSSP, 2012). The European Commission (EC) and the International Fund for Agricultural Development (IFAD) have funded the research grant *"Food Resilience Through Root and Tuber Crops in Upland and Coastal Communities of the Asia-Pacific"* (FoodSTART+, 2015-2019) which partnered with five large scale IFAD investments (in Philippines, India, Indonesia and Vietnam) to enhance food resilience in upland and coastal communities of the Asia-Pacific region through the introduction of RTC innovations. The project, led by the International Potato Center (CIP) under the umbrella of the CGIAR Research Program on Roots, Tubers and Bananas (RTB), has tested and validated partnership models with IFAD investments for taking the most promising RTC innovations to scale and enhance the capacities of national implementing agencies to achieve their development goals.

The regional congress "Root and Tuber Crops for Food Security and Climate Change Resilience in Asia" was organized by CIP and the Department of Science and Technology - Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARRD) in collaboration with the Philippine Root Crop Research and Training Center (PhilRootcrops) of the Visayas State University (VSU) with financial support from the International Fund for Agricultural Development (IFAD) and the European Union (EU) . The congress was a venue for discussing and promoting cross learning in RTC science and technology, policy measures, and pragmatic approaches for exploiting opportunities and challenges especially amidst climate change challenges. As FoodSTART+ was reaching its end, it was also be an opportunity for holding its final event, evaluating its results as input into the completion report and sharing some of the key findings and good practices with the scientific community, relevant national agencies, development practitioners, farmers' organizations, private sector and the wider public.

The congress aimed to the following:

1. Provide a platform for sharing and increase awareness of policy makers, development organizations, farmers' organizations and the wider public about RTC-related opportunities and constraints, especially amidst climate change challenges;
2. Disseminate and promote technological, commercial and institutional RTC innovations across the value chain actors;
3. Share FoodSTART+ key findings, knowledge products and recommendations for further scaling up, and gather input and feedback to feed into the preparation of the completion report:
4. Provide a forum for public-private sector discussions and stimulate interaction and future collaborative undertaking to enhance the contribution of RTCs to regional food/nutrition security and resilience; and
5. Enhance awareness of and visibility of EC contribution to national and regional agricultural program development at policy level (governments/EC delegations in countries and region).

Its expected outputs are the following:

1. Opportunities and challenges of RTCs in relation to climate change, food security and livelihoods identified, discussed and validated;
2. Awareness of available RTC technologies and innovations across R&D institutions and private sector in the region enhanced;
3. Participants' feedback on FoodSTART+ to be considered for preparation of grant completion report; and
4. Physical products, including: articles to be published on national newspapers, videos to be broadcasted in national TVs, leaflets, posters, booklets and press releases

It also aimed to achieve the following outcomes:

1. Reinforced dialogue and strengthened capacities of researchers, extension workers, policy makers, private sector, development practitioners, farmers' organizations and donors for future collaborative undertakings aimed at promoting and supporting RTCs, and scaling up promising innovations for regional food/nutrition security and resilience;
2. Improved understanding of scope of EC/IFAD-funded FoodSTART+ outputs, its potential development outcomes and the impact of putting research into use at scale to achieve enhanced food security, resilience to climate change and agriculture sustainability;
3. Greater awareness among researchers, extension workers, development practitioners and farmers about EC support to develop and test innovative approaches with potential to impact positively on the livelihoods, nutrition or resilience of rural communities; and
4. Increased appreciation about EC investments in the Agricultural Research for Development (AR4D) initiative and direct influence on government policies, public and private sector agricultural investments and adoption of technologies and innovations developed and tested with EC funding.

The congress was held on October 17 to 18, 2019 at Luxent Hotel, Quezon City, Philippines. A total of 115 participants from 11 countries including representatives from the government agencies, research institutions, academia, farmer's cooperatives, private sector and media attended the congress (see Annex 1 for the list of participants).

HIGHLIGHTS OF THE ACTIVITIES

DAY 1: OCTOBER 17

I. OPENING PROGRAM

Master of Ceremonies: Dr. Lilian Bondoc, *DOST-PCAARRD*

Welcome message

Mr. Jing Pacturan, *IFAD Philippines Country Programme Officer*

Mr. Pacturan opened the program by welcoming the participants of the Congress. He discussed the rationale and main objectives of the activity which include increased awareness of the wider public about RTC-related opportunities and constraints, and enhanced interaction for the public-private sector to discuss future collaborative undertakings, among others.

He also provided an overview of FoodSTART+, a project co-financed by the EC and IFAD. He emphasized that the two-day congress represents the final, completion activity of FoodSTART+. He also said that key findings of each investment project which partnered with FoodSTART+ will be shared to come up with recommendations on how to further scale up the introduced RTC innovations. In particular, he discussed how farmer business school (FBS), as introduced through FoodSTART+, was used as a framework for introducing, testing, adopting, and promoting several technologies to improve production and postharvest management of RTCs in Indonesia, Vietnam, India, and the Philippines. He reported that participating farmers' groups were able to develop market-driven innovations, establish and expand market linkages, and generate more income. He also shared that IFAD is very pleased with the results of the program as they are well in line with the goals of IFAD in providing grants to research projects.

Welcome message

Dr. Samarendu Mohanty, *CIP Regional Director for Asia*

Dr. Mohanty thanked the organizers of the congress, IFAD, and all the international and national partners of FoodSTART+. He likewise congratulated Dr. Diego Naziri and his team for the successful completion of FoodSTART+. He went on by discussing the past and ongoing initiatives of CIP in Asia as well as its prospects for R&D programs. Specific focus areas are crop diversification, consumption, and value adding. He shared that CIP is now working on more upstream R&D partnership. CIP is focusing on capacity building of its partners in the region, particularly for precision breeding and genome editing initiatives.

He added that market linkages and value chain development have been a key focus of CIP over the years - an example of which is FoodSTART+. CIP is introducing and disseminating low-cost production technologies (i.e., for seed production) that are strategic and beneficial to farmers. The marketing of the produce is likewise addressed by the CIP programs as farmers are guided on how and where to market their products.

Dr. Mohanty shared that CIP is also looking at other models to strengthen its value chain focus. He cited as an example the consolidation of small-scale farmers in Vietnam which aims to take advantage of economies of scale. In conclusion, he said that CIP strives to promote systems approach for crop intensification in cereal based systems (i.e., rice-potato; wheat-potato; rice-sweetpotato); train next generation potato and sweetpotato scientists; and integrate gender and the youth across all its activities.

Welcome message

Dr. Edwin C. Villar, *DOST-PCAARRD Deputy Executive Director for R&D*

Dr. Villar shared that CIP has been an invaluable partner in pushing forward many scientific and technological efforts toward the development of the local RTC industry. He said that CIP has been instrumental in the development of DOST-PCAARRD's Industry Strategic S&T Program (ISP) for Sweetpotato and in the implementation of the project titled "S&T-based value chain development for food in Tarlac, Albay, Leyte, and Samar." The said project has been successful in generating more food products and technologies using sweetpotato and in highlighting its potential to contribute to climate change adaptation and food resilience in disaster-prone communities in the Philippines. He stressed that it is through the project that the agency and its implementers were able to foster stronger linkages with the food industry, thereby improving the income and overall livelihood of the local farmers.

He added that the congress is an opportunity for the participants to learn more from the experience and expertise of each other particularly in technological, commercial, and institutional RTC innovations across the value chain. DOST-PCAARRD hopes for a continued fruitful partnership with CIP and aims to capitalize on research outputs to bring about more meaningful R&D innovations in the RTC sector.

He ended his message by thanking the Philippine Root Crop Research and Training Center (PhilRootcrops) of the Visayas State University (VSU), CIP, IFAD, and EU for the conduct of the activity. He shared his desire for the congress to only be one of the many activities that the agencies will be working on together.

Keynote address

Dr. William D. Dar, *Philippine Secretary of Agriculture*
Delivered by: Usec. Cheryl Marie Natividad-Caballero, *Department of Agriculture*

Secretary Dar, through Usec. Natividad-Caballero, shared that the Department of Agriculture (DA) pursues a systematic and long-term strategy in attracting private investments, developing markets and promoting exports of raw and processed agricultural products under the banner "New Thinking for Agriculture." This banner is built around eight paradigms to usher in higher rate of growth and employment: modernization of agriculture, industrialization of agriculture, promotion of exports, farm consolidation, infrastructure development, roadmap development, higher budget and investments for agriculture, and legislative and regulatory support.

The focus of this "New Thinking" is the Inclusive Market-Oriented Development (IMOD), a strategy to modernize the country's agriculture sector, boost its resilience against climatic stresses, create employment and income opportunities, and uplift the living conditions of millions of smallholder farmers. These are towards the goal of a food secure Philippines with prosperous farmers and fisherfolk.

As for Philippines' root and tuber crops industry, the local production of cassava and sweetpotato last year totaled 3.25 million mt, worth PHP2.7 billion at current prices. These crops are grown on 312,000 hectares nationwide.

Usec. Natividad-Caballero also discussed the effect of globalization of markets on Philippine agriculture. She highlighted the challenges and opportunities presented by globalization to the RTC industry. The challenge comes from the need to ensure the quality of local products at competitive prices and produce them with economies of scale. However, the heightened competition also offers the opportunity to strengthen the national agricultural support system to prosper in the context of our international trade agreements.

She cited the current standing of the Philippines relative to its ASEAN peers in terms of land productivity, crop diversification, and exports. In order to address this, she discussed the plans of DA through the Bureau of Plant Industry and High Value Crops Development Program. These include the availability of high quality seeds and planting materials to support the expansion program for priority RTCs; establishment of postharvest facilities; promotion of value addition initiatives; stronger market information and market linkages campaigns, improvement of national regulatory and support services (certification systems, pest risk analysis, and food safety services); and development and promotion of better production technologies through various modalities [Farmer Field School (FFS), Package of Technology (POT), and Training of Trainers (TOT)].

She mentioned the rehabilitation of existing production facilities and establishment of new rain shelters, greenhouses, nurseries, and tissue culture laboratories in research stations nationwide. These are all expected to be linked to the key players in the market and private sector. To aid this, DA will bank on its strong partnership with local government units, extension workers, farmer-leaders, rural-based organizations, entrepreneurs and other development partners in communities to bring a vital government service to grassroots level. Likewise, DA will pursue lawmakers to approve its proposed budget of PHP71.8 billion to address the urgent need of rapid agricultural development. Said budget aims to put forth measures designed to encourage small business initiative, facilitate credit, and stimulate economic progress through competition.

DA also intends to promote greater private and public investments, and provide technical advice and support to agribusiness on production, research, and management issues. These are all expected to build firmly on the country's comparative advantages, and to make its agriculture competitive in terms of availability, quality and price. In closing, she asked for wholehearted support to DA's undertakings to yield better results in terms of harvest and income.

Overview of the congress

Dr. Diego Naziri, *CIP FoodSTART+ Coordinator*

Dr. Naziri discussed the significance of RTCs to food security, particularly in providing micronutrients and vitamins, and their ability to produce high yields under harsh climate conditions. He also presented the global and regional scenario of RTC production. He reported that Asia has now become the largest RTC crop-producing region. Much of the growth relate to potato and sweetpotato production in China. Cassava production, on the other hand, is concentrated in Southeast Asia, particularly in Thailand, Vietnam, and Indonesia. He added, however, that RTCs receive only a fraction of the attention given to other food commodities. He quoted Petsakos et al. (2019), "In spite of research investment in developed countries to improve yields and consumer traits of potato, root, tuber and banana (RTB) crops in the developing world have received little benefit from productivity growth as a function of R&D spillover compared to commodities like cereals and livestock."

He then discussed the overarching goal of the FoodSTART+ which is to enhance food resilience among poor households in upland and coastal communities of the Asia-Pacific region, through introducing RTC innovations, primarily within the framework of IFAD investments. The project's objectives are aligned to IFAD's Strategic Framework 2016–2025.

He went over the objectives of the congress and the overview/mechanics of the congress proper. He stressed that the first session will be focusing on experts' presentations followed by a Knowledge and Learning Fair (KLF) where RTC innovations are presented, two roundtable discussions, and a field visit. A book titled "Connecting smallholder root and tuber growers to markets through Farmer Business Schools" will also be launched during the congress.

He then enumerated the expected outcomes of the activity and presented the detailed programme for the two-day congress (see Annex 2 for the programme).

II. KEY EXPERTS' PRESENTATIONS

Climate-smart breeding: Experiences from the CGIAR Research program on roots, tubers, and banana (RTB)

Dr. Neeraj Sharma, *CIP-Vietnam Potato Breeder*

Dr. Sharma stressed on the need to harness the untapped potentials of RTB crops toward improved food security, nutrition, and income. He mentioned the alliance between CIP, Bioversity International, CIAT, CIRAD, IITA, and about 350 partners under the CGIAR RTB program. He also presented the RTB structure and its flagship projects which include: enhancement of the genetic resources through trait identification, genotyping and phenotyping; production of improved varieties and quality seeds through varietal selection; improved crop management and deployment of climate change resilient crops; nutritious food and value added; and enhancement of livelihoods at scale (modelling).

He stressed the direct and indirect effects of climate change particularly on crop production. He said that through climate-smart breeding, newly developed varieties are better suited to address risks in production such as changing climatic conditions and associated factors in production.

In addition, he discussed strategies that can be adopted to prepare for the adverse effects of climate change. He said that there is a need for a faster and more innovative approach on breeding RTB crops since it needs a long period to develop a desirable germplasm. He emphasized that researchers and/or breeders should also consider factors such as the changing end-user preferences (taste, texture, processing quality) and market dynamics; farmer's perception; trade-off between contributing traits; crop breeding cycles; and the environment.

Recent developments and examples in RTBs that helped farmers overcome the impacts of climate change were also discussed by Dr. Sharma.

The following are the six-steps proposed by RTB for climate-smart breeding framework that, as emphasized by Dr. Sharma, will greatly help in the development of varieties amidst climate change:

- Downscaling climate change models and crop modeling;
- Identifying and understanding key-climate change responsive traits;
- Breeding and varietal selection;
- Phenotyping and genomic research to accelerate gains;
- Developing management options for climate-change smart varieties; and
- Deployment of an improved seed system of climate change smart varieties/crops.

Management options for cassava production systems under variable climate scenario

Dr. Imran Malik, *CIAT Cassava Production Systems Specialist*

Dr. Malik briefly discussed the effects of climate change on precipitation pattern, incidence of drought and heat waves, and CO_2 increase. He noted that a large proportion of the world's poor rely on subsistence farming and so are directly affected by the impacts of climate change. One of crops identified as resilient to the effects of climate change is cassava. It has a remarkable ability to tolerate and recover from biotic and abiotic stresses. It is widely adaptable as it can grow at sea level up to above 2000 m asl. Cassava can also be grown in marginal and highly-eroded low fertility acid soils, with an average yield of 11 t/ha (world), 9 t/ha (Africa), and 22 t/ha (Asia). He stressed that some improved varieties of cassava under near-optimum conditions can yield as high as 90 t/ha. The most diverse utilization of cassava has been noted in Asia. It is used for processed food, animal feed, and biofuel for vehicles, among many other uses.

Dr. Malik then discussed the main abiotic stresses faced by cassava (longer drought; increased flooding; frequent cold and heat wave; stronger storms, cyclones and hurricanes; and greenhouse gas and increase levels of CO_2) and how it copes. He also showed the crop suitability map of cassava under different climate change scenarios. Comparing the current climatic conditions to the ones projected under the Representative Concentration Pathways (RCP) 8.5, he emphasized that the suitability of areas for cassava production is expected to remain just about the same. This is an entirely different scenario for maize which would suffer detrimentally under RCP 8.5.

Dr. Malik also discussed the change of weather patterns (i.e., temperature and rainfall) observed in the Southeast Asian Region. The change of monsoon rain and overall weather pattern leads to shifting of planting date by farmers to adapt as monsoon rainfall determines the sowing time for rain-fed crops. He concluded that as cropping pattern is likely to shift, what R&D should prioritize is the screening for traits that provide enhanced resilience to climate variability.

As cassava can tolerate abiotic stresses, climate model suggests that greater impact on cassava production will come from biotic stresses. Examples of which are the pest and disease occurrence and the changing pest population dynamics brought about by changing weather patterns. Cassava mosaic disease, for instance, is spreading very fast in the Southeast Asian Region. Indonesia and the Philippines are still unaffected but it could be just a matter of time before the disease spreads in the said countries. He noted that in regions where the current temperature is above the bacterium's optimum temperature (22–26°C), the importance of the disease will tend to remain similar or lower because rising projected temperatures will be unfavorable to it. For regions where current temperature is below the optimum, the increase in temperature will favor the occurrence of epidemics.

In order to combat biotic stresses, he suggested the following options: genetic resistance (screening for resistance); biological control (i.e., parasitoid wasps for controlling cassava mealybug); change of cultural practice (i.e., crop rotation, intercropping); and rapid multiplication of disease-free planting material. CIAT has conducted a screening for disease resistance against cassava mosaic virus on six varieties: KU50, Rayong 11, SC8, HuayBong60, KM98-1, and Rayong 5.

Dr. Malik stressed that variation in disease susceptibility is present and that clean planting materials (i.e., seed) is essential as an immediate solution. He concluded that:

- the knowledge on the potential impact of climate change on pests and diseases in tropical crops is still limited;
- predicting pest outbreaks and subsequent crop damage due to climate change is difficult;
- cropping patterns will likely change in response to changing climate; and
- cassava tolerates prolonged drought due to its bio-physical characteristics, including partial closure of stomata, deep rooting systems and small leaf canopy.

Open forum

Moderator: Dr. Diego Naziri, *CIP FoodSTART+ Coordinator*

1. **Dr. Anantharaman:** Do you coordinate with CPRI (for Kufri potato varieties) in India since they have already released varieties?

   Dr. Malik: Yes, in India there is ongoing a collaborative effort in the research station.

2. **Dr. Anantharaman:** Aside from breeding, what are the agronomic practices recommended to work on the problems on cassava production?

   Dr. Malik: In India, vertical planting has been recommended but we also need to follow the shift in rain pattern (i.e., modification in irrigation practices). There is a difference in vertical and horizontal planting especially during drought season.

3. **Researcher from India:** Can we have more details about your research on cassava? Do you have any publications that we can access?

   Dr. Malik: There are published works showing the data I have presented. I can guide you on how to access the information. They are all open access.

4. **Ms. Emily Monville-Oro:** IIRR works directly with farmers. We learned that there should be an uptake and access of farmers to climate-resilient crops and varieties. What mechanisms have you identified to ensure that access and uptake of technology will happen?

   Dr. Sharma: Planting materials is an important factor. Unfortunately, you won't see many private sectors involved in deployment. We are trying to involve farmers in production of clean planting materials (seed multiplication, etc.).

5. **Ms. Emily Monville-Oro:** People eat because they like the taste and texture. Up to what extent do you think these agronomic traits and consumer acceptance marry in your consideration for identification of technologies particularly in breeding?

   Dr. Malik: Farmers participate in demonstration farms. We engage with farmers and select material based on their preferences (i.e., what works and what doesn't work). For seed dissemination, it is challenging because there is no formal seed system for cassava.

   Dr. Naziri: CGIAR research centers work closely to identify consumer preference so that the new varieties meet the needs and preferences of the consumers. Cooking test and consumer preferences are integrative part of our breeding program).

III. FoodSTART+ EXPERTS' PRESENTATIONS

Contribution of RTCs to agri-food system resilience in Asia - focus on India and the Philippines

Dr. Gordon Prain, *CIP FoodSTART+ Technical Advisor*

Dr. Prain said that coping with climate change is not an academic issue, it is about action, for the future, for the children, it is something that we must do.

He also discussed the history of the concept of resilience and its context. He also said that its scientific origin is in the literature on mechanics, described as the robustness and ductility of steel.

Also, he said that resilience in agriculture should look at the whole agri-food systems (ecological and social functions)

Resilience and Food Security

- Food stability which focus on food availability – it is about maintaining availability/status quo and adequacy of food to offset fluctuations of foodstuffs (returning to the previous situation)

- Food vulnerability relates to food access –designing interventions to strengthen food access of vulnerable populations

Food Resilience includes the following:

- Self-determination (Food sovereignty) for access; and
- Utilization (traditional foods)
- However, the weakness of these factors is that the environmental and systems dimensions of food security are often disconnected.

What we need to do to address the weakness:

- Social-ecological systems thinking;
- Lessons from the food disaster literature – diversity, governance and bouncing forward;
- Lessons from the food and nutrition literature – intrahousehold assets, decision-making, agency, social capital.

Agri-food system resilience is the key element in describing the word resilience. It has four components:

- preparedness (to shocks and stresses);
- ability to cope with shocks and stresses related to climate change;
- ability to adapt;
- Long-term transformation in the face of climate change

The framework comprises elements of household and agro-food ecological systems intertwined and interlinked subsystems. Shocks and stresses have direct impact to food security outcomes.

- Responses of the agents (men and women involved in the agri-food system) of their agency (preparedness, coping, adaptation, transformation)
- The framework will help understand the different situations in the agri-food systems.

Examples of Agri-food systems resilience and RTCs:

He discussed the world population engaged in *shifting agriculture and ethnic minorities*

- RTCs are integral to agri-food systems in these settings.
- A continuous food supply in response to shocks and stress where planting RTCs are most beneficial to the indigenous people in S, and SE Asia, and NE India.

Causes of shifting to permanent agricultural transformation

- due to increase commercialization of food,
- expanding markets,
- efficient productivity of crops;

Agri-food systems resilience and RTCs in flood plains and coastal areas:

- RTCs are planted as secondary crops and used as primary foods for resilience functions;
- Coastal areas are using RTCs as food sources – *weather proofing*
- RTCs – profitable winter season crop between rice seasons.

Practical insights of preparedness to calamities from men and women in Meghalaya, India, and Samar Philippines were also discussed.

Due to the experiences of people of environmental stresses in crop production such as super typhoons, drought, and hailstorms, the people of Meghalaya India, and Samar Philippines, have responded through:

** Recovery through adaptation:

- People moved into alternative farming and fishing and diverse diets;
- Transformation to other sources of income (migration to Manila or outside the Philippines);
- Government assistance for affected businesses.

** Subjective Resilience

- Decision making, social capital (what people feel in that gives them a sense of resilience?) (how do poorer people develop self-reliance?)

Qualities of subjective resilience should be an integrative part of a community in coping up with the factors that may affect agri-food systems.

Modeling the future contribution of RTCs to resilient agri-food systems in Asia amidst climate

Mr. Leo Palao, *CIAT Senior Research Associate*

Mr. Palao discussed the climate change assessment of various RTCs. The study covered China, India, Myanmar, Vietnam, Philippines and Indonesia (FoodSTART+ areas).

He discussed the climate change impact on crop production, particularly to answer the question: How land use will likely change in face of variation in temperature and rainfall due to climate change?

He cited various sources on climate change effect:

1. Agriculture is a climate-dependent activity, being highly sensitive to climatic changes and climate variability. It controls 33% of global crop yield variation (Ray et al., 2015);
2. As reported by Balderama et al. (2016) maize yield can decrease by 44% by 2050 under RCP 8.5 scenario using CERES-Maize model;
3. Biomass production decreases by 10% for each 1°C increase in minimum temperature in the growing season, which translates to a decline by 15% in grain yields (Peng et at., 2004);
4. Without extensive adaptation, about 52% in reduction of rice yields can be expected due to increase in mean temperature by 2050 (Li et al., 2017);
5. Root crops (i.e., cassava) and drought-resistant cereals have the least climate impacts in Sub Saharan Africa based from the simulation of climate impacts by Rippke et al. (2016);
6. Climate resilient-pathways can involve two phases – incremental and transformational change (Denton et al., 2014). In cropping systems where impacts of climate change render the system less viable, then options should be considered to introduce crops with higher suitability or redefine livelihoods (Rippke et al., 2016).

He showed the framework that the research team developed for analyzing the climate change impact to land suitability of crops. They used two modelling frameworks (EcoCrop and Ensemble Model) and assessed their accuracy. Key results: Simulations showed that some excellent growing areas in China, Myanmar, India, etc. will be less suitable (marginal) in the future. But some also showed prospective excellent growing area (niche) after shifts in climate domain. The production of sweetpotato in terms of climatic domains will be stable in terms of climate change impacts. The same goes to cassava – with more expansion in the eastern part of China. For potato, receding suitability in Philippines, India and Myanmar.

The study showed that large transformational areas are simulated for maize, followed by potato, and rice across Asia. Also, reduction of maize, rice, and potato "climate suitability" were mainly driven by temperature, and temperature-derived parameters (°C seasonality).

Crops transformation change based on climate impacts: limited rice areas in Uttar and Andhra Pradesh can only be substituted by cassava and sweetpotato. Likewise for rice, root and tuber crops can have comparative advantage in Guangxi and the narrow stretch of the eastern seaboard in India.

He concluded that:

- Mechanistic and empirical ensemble machine learning models were used to assess potential impact of climate change to crops under RCP 8.5 scenario;
- Countries such as India, China, and Myanmar will experience high impacts of climate change in terms of climate suitability for maize;
- Although there is a general decrease of climatic suitability for rice, the viability threshold was not crossed across time periods for most areas;
- Among RTB crops, cassava and sweetpotato can play an important role in terms of food resilience in areas where climate change is likely to trigger transformational changes;
- In terms of food resilience, considerations and emphasis on the role of cassava and sweetpotato should be integrated in any adaptation initiative, especially in countries where food systems and value chains are particularly threatened by climate change.

He concluded by recommending further analyses incorporating additional risk factors related to climate variability, including extreme weather events (drought, typhoon) which puts additional pressure to key crops.

RTCs for reduced vulnerability to climate-related shocks: The case of super typhoon Ompong in the Philippines

Dr. Christophe Bene, *CIAT Senior Policy Expert*

Dr. Bene discussed that the Philippines is exposed to extreme weather conditions. Coping strategies of farmers were also discussed, including the following (1) draw on savings; (2) reduce consumption/expenses; (3) sell (productive) assets; (4) and change their choice of crops.

The objective of the study is to provide evidence on how RTCs contribute to household resilience to climatic shocks in the Philippines. In particular to test the following hypotheses:

- RTCs are more resistant to adverse climatic factors than above-ground crops. Hence RTCs experience lower yield losses compared with above-ground crops.
- Households who plant RTCs bounce back faster than those who plant above ground crops.

He presented the findings and results of a study on the effect of Typhoon Mangkhut to validate the different hypotheses he formulated about the role of RTCs to enhanced resilience of farmers.

Results of the study: Underground crops suffered little damage (sweetpotato 8%, taro 12%, cassava 15%, yam 22%) compared to above-ground crops (maize 48%, rice 51%, banana 77%).

The key findings are as follows:

- RTCs are somehow resistant to the adverse effects of typhoons;
- Households have higher consumption of sweetpotato and cassava after disaster, contributing to food security;

- Sweetpotato growers are less likely to use their savings or rely on their neighbors; while hypothesis on cassava growers is only partially fulfilled.

His conclusions included:

- RTCs are more resistant to extreme weather events (less loss/damages due to weather conditions);
- Some RCTs are likely more "effective" than others
- Relation to food security is still to demonstrate;
- Need to better control for income confounding effect.

He further stressed that more research is needed on RTCs.

Open forum

Moderator: Dr. Diego Naziri, *CIP FoodSTART+ Coordinator*

1. **Ms. Guada Babilonia**: If we are to engage in research about resilience, what could be the best measures to quantify resilience?

   Dr. Bene: Resilience has been tried to be quantified but the interpretation and measure is geared more towards other areas or elements of resilience such as food security, comparison of past (baseline) to present (which can be measured).

   Dr. Prain: Resilience is not always positive. There are trades off. One of the coping mechanisms is to send young girls to work in the town. Reduces the consumption at home and increases home income (after labor). But higher exposure of risks for the young girls.

2. **Julian Gonsalves:** The focuses of FoodSTART+ are resilience, food security, etc. We know that most RTCs can tolerate climate change impacts. Can we promote RTCs as anticipative response in places that don't currently grow RTCs? We had a history of failure of introducing these kinds of crops.

   Dr. Prain: One of the key elements of resilience is diversification. The message of diversification is very widely disseminated, including in cereal-based systems in Asia. The next message is about the important role of underground crops. There are things that are changing. Eg., in China, cassava and sweetpotato are becoming "health-food crops" unlike the previously "pig food or poor-food". Changing the food habits is the key.

   Dr. Mohanty: The connotation of sweetpotato is changing from poor food to healthy food. It is a super crop with many benefits. The farmers find it difficult to take a risk because of the cereal bias.

   Dr. Bene: We don't like change. Farmers won't shift their production unlike they are forced to do so. Unless the farmers see for themselves the need for RTC production, it would be very difficult to encourage them. That is basically the behavior of farmers. It is important to understand that change entails cost.

IV. SELECTED CASES ON RTC INNOVATIONS AND TECHNOLOGIES

Overview of the Knowledge and Learning Fair

Dr. Diego Naziri, *CIP FoodSTART+ Coordinator*

Dr. Naziri discussed the overview and mechanics of the Knowledge and Learning Fair (KLF). The main goal of the activity is to showcase, present and discuss RTC innovations (e.g. new technology, product, approach) from selected organizations. It also serves as an opportunity to exhibit and display RTC products and relevant communication materials (i.e. posters, leaflets, books, brochures, videos, etc).

The KLF Mechanics are the following:

- Official opening/ribbon cutting
- Round 1 Case presentations: participants are free to choose the 1st mini-workshop to attend. Each group will select one Facilitator and one Rapporteur for the Q&A. At the end of the mini-workshop, each participant will choose where to move for the 2nd and 3rd mini-workshops (3 in total).
- Round 2 Break-out groups: each participant will go to the last booth that s/he has joined and work in group to analyze the case of innovation more in depth.
- Round 3 Reporting from groups: rapporteurs of each group will present in plenary the highlights of the discussion (good practices & elements of success; potential; gaps & challenges; conditions & partnerships needed for scaling)
- KLF viewing and interaction

Each KLF participant was given one minute to pitch their innovations.

Production of clean planting materials to address sweetpotato viruses and other pests in Central Luzon, Philippines

Dr. Lilibeth B. Laranang, *TAU Director of Rootcrops Research and Training Center*

Brief description of the innovation and case presentation

Good quality planting materials is key to high production of crops. Pests such as pathogens/diseases and insect pests limit productivity of most crops, including sweetpotato. A number of viruses (10) attack sweetpotato in the Central Luzon region of the Philippines, either singly or in combination causing serious losses to the crop. This prompts researchers to develop strategies to address the problem. The utilization of clean planting materials was proven to be the sole measure that could effectively control widespread virus diseases in the region. Production of clean planting material involves thermotherapy and meristem culture to clean up sweetpotato against viruses. Indexing against viruses through NCM ELISA tests and grafting with Ipomoea setosa are carried out to confirm the absence of viruses in the tissue culture generated plantlets. Plantlets found positive are discarded while those that are negative are further propagated through tissue culture and later multiplied inside nethouses through single node cutting. Multiplication through single node cuttings is done over two generations before these are planted in multiplier farms. The challenge is for the planting materials to be kept free of the viruses and weevil until it reaches the end-users. This phase of the multiplication process is done

by farmers that were trained and are accredited by the Bureau of Plant Industry. Regulation of the distribution of the planting materials has to be enforced to maintain the integrity of the clean planting materials.

Innovative features and relevance to climate change

This innovation plays a vital role in our quest to mitigate the effect of climate change. Sweetpotato in itself is a resilient crop that can replace rice or serve as an alternate crop. It can survive typhoons and will likewise survive with limited water as compared to rice.

High incidence of pests and diseases is another challenge every farmer face. The problem of viruses and insect pests (vectors) may increase several folds with the change in environmental conditions, if not properly addressed. One of the measures to alleviate the problem is the use of clean planting material. Since several pests are carried through planting materials, the utilization of these pest-free (virus-free) planting materials will lessen the problems on disease occurrence.

Questions from KLF Participants

What are the sweetpotato viruses in the Philippines that have been already detected or identified?

So far, there are ten viruses identified in the Philippines. These are the SPFMV, SPLV, SPCFV, SPC6V, SPMMV, SPMSV, SPCV, SPCSV, SPVG, and CMV. Virus identification depends on the virus antisera available on the NCM ELISA kits that we use. These are purchased from CIP Lima, Peru.

What is the process of thermotherapy? Would heat treatment not be enough to kill the virus?

Thermotherapy or Heat Treatment is being used in the clean-up process to delay the movement of the virus to the meristem. This process allows greater chances of obtaining a virus-free meristem because of larger virus-free area to work on while doing the meristem culture.

Are there other means to manage/control persistence of sweetpotato viruses in the field?

Rouging, control of the identified insect vectors and alternate hosts are some of the measures employed to control the SPVD and other virus diseases attacking sweetpotato, but this has to be done in combination with the use of clean planting material. So far, it is the only feasible measure to control/manage the disease since there are no varieties that have been identified to be resistant to the disease. Likewise, a higher yield is realized when clean planting material is used as one of the components of the Integrated Crop Management for sweetpotato.

Why is there a need to subject it to NCM-ELISA and PCR? What is the difference?

Both are virus indexing procedures. We use these to detect/identify the viruses associated with the sweetpotato plants. ELISA or Enzyme-Link Immunosorbent Assay is a serological test that makes use of available antisera of viruses. The NCM-ELISA kits from CIP that we are using contain ten antisera of sweetpotato viruses. The number of antisera available in the kits limits the viruses that can be identified. The kits are not locally available and have to be procured from CIP in Lima. PCR on the other hand is a molecular assay that can be done by trained personnel and laboratories that are equipped with necessary PCR equipment and laboratory supplies and reagents. The need for polyphasic indexing is necessary for a more reliable identity of viruses affecting the crop.

How is the flow of production and distribution?

The flow of production is illustrated in the diagram presented. SP-CPM production starts from the collection of apparently "healthy" sweetpotato roots from the field that are induced to sprout after proper disinfestation. Production involves the clean-up process that requires thermotherapy and meristem culture. Virus indexing of meristem-cultured plants follows by employing bioassay or grafting with Ipomoea setosa and serology using the NCM ELISA test. Molecular bioassay or the use of PCR is an option that is being studied at the moment.

Can the process be replicated? If ever, can it be done outside of Central Luzon? Like Quezon province or Palawan? What are the requirements? Do you conduct trainings? How can farmers avail of the training?

Yes, the process can be replicated. We already have established protocol although we still have to optimize the indexing process. The laboratory aspects can be done by established institutions with trained personnel and equipped laboratories. On the other hand, the component on mass propagation of SP-CPM is undertaken by trained farmers with accredited nurseries to achieve distribution of certified clean planting materials. We have trained farmers from different provinces, and they are already commercializing clean planting material of sweetpotato.

Nethouses are necessary in the propagation of clean planting material to avoid the plants from being exposed to insect vectors such as aphids and whiteflies that may carry viruses. One prime requisite in the propagation of clean planting material in the field is to establish multiplier farms in non-traditional sweetpotato growing areas where there is no history of the presence of SPVD and other viruses attacking sweetpotato especially the sweetpotato feathery mottle virus (SPFMV). We conduct trainings both for agricultural extension workers and farmers usually following the Farmers Field School modality. We team up with the Local Government Units (LGUs) and other agencies in doing this.

What are the market aspects of clean planting material of sweetpotato?

There are groups of trained farmers who are propagating the clean planting material. They sell their material to sweetpotato farmers in Tarlac province and other parts of the Central Luzon region, sometimes, outside the region. Usually, farmers buy only a portion of their planting material requirements from these propagators then propagate/multiply it further. Traders who supply the Department of Agriculture for their sweetpotato planting material's subsidy program buy from these propagators who have formed a cooperative.

Rooted apical cutting technique for the production of quality planting material of potato: The Cordillera Administrative Region (CAR) Philippines experience

Ms. Cynthia G. Kiswa, *BSU-NPRCRTC Director*

Brief description of the innovation and case presentation

The production of basic seed consists of several components spanning from selecting the source of explants to the multiplication and post-harvest techniques. The improved seed system in CAR starts from tissue culture (TC). The TC plantlets are transplanted in the greenhouse where mother plants are maintained for foundation seed production (stem/apical cuttings producing the generation-zero tubers). The rooted stem/rooted apical cuttings or G-0 tubers are passed on to

farmers for further seed multiplication which is referred to as the semi-formal seed system. This system had helped the average potato yield in CAR from 15 t/ha to 18 t/ha.

Innovation to the Rapid Multiplication Technique (RMT) for enhancing the quality of planting materials is anchored on the rooted stem/apical cutting technique which includes the utilization of different planting for RMT, pea-sized seed tubers that are harvested from the mother plants or from closed density planting (50–80 apical cuttings in 7"X11" polyethylene pots), repetitive harvesting to increase the quantity of basic materials, two to three times hilling-up to cover more nodes that enhances stolon growth for tuber initiation, high population density in greenhouse planting, use of bio-stimulants to increase resilience by enhancing plant health, and selection of pest/disease resistant varieties. In addition, production facilities include utilization of drip irrigation and wind breaks for more sustainable production amidst climate change.

Innovative features and relevance to climate change

Rapid multiplication of quality potato planting material of well adapted and pest/disease resistant varieties are among the good agricultural practices to mitigate climate change. Healthy planting material is the first line of defense against crop pests and diseases. The use of quality planting materials helps minimize the use of synthetic and potentially toxic pesticides.

Location specific or seasonal specific varieties like Igorota, Bengueta, Solibao, Montanosa, Dalisay, Ganza and Gloria are among the improved potato varieties that could grow in highest elevation (2300 to 2900m asl) of the Cordillera Region; variety Raniag grows well in both low, mid and high elevations just like the old favorite variety Granola. The tolerance of these varieties to late blight, and some to bacterial wilt, potato viruses and insect pests like the leaf miner contributes to enhanced productivity.

Questions from KLF participants

What is the cost of production using the apical cutting technique compared to conventional seed production?

The cost of production is reflected on the different cost of planting materials: 80 pieces of rooted apical cuttings are sold are at 1.94 USD with a net profit of 48%. In the conventional seed production, farmers repeatedly save from their harvest for the next growing season. This contributes to the rapid degeneration of the planting materials because of the accumulation of diseases that, in turn, reduces yields.

How much is farmer's seed compared to clean seeds?

Precisely, farmer's seed is much cheaper than the clean seeds. Usually, clean seeds are sold at a range of 1.00 to 1.55 USD per kilo depending on the class of the seeds (what generation the seed tubers are). Farmer's seeds are sold at 0.48 to 0.68 USD per kg.

How many times do you use imported seeds compared to seeds produced through in-vitro?

The cycle production from in-vitro seeds to G1 seed tubers takes four cycles before it could be used for seed for food production while imported seed depends on the class of the seeds. The lowest grade it should be used once, while if the imported seed is of higher quality the it can be repeatedly used. However, the number of times it can be used depends on the several factors like soil quality, management, climate, variety and etc.

What generation do they sell?
The farmers definitely don't share or sell from G1 seed tubers, for G2 seed tubers 30% are sold for table and G3 seed tubers 70% are sold for table because the size of these tubers is large. But if their neighbor farmers know the class of the seed tuber they will buy it for seeds even if it is large size thus they don't bring it to the agricultural trading post.

How much seed is the Philippines importing?
No exact statistical figure for imported seeds in the Philippines, but entrepreneurs in the country started importing seeds in the last four years.

What is BSU's capacity to produce clean planting materials?
The government, Benguet State University-Northern Philippines Root Crops Research Training Center (BSU-NPRCRTC) and Bureau of Plant Industry-CAR in partnership with some trained potato farmers could only produce about 13% of the clean seed requirement.

How to increase supply of clean planting material?
Choose farmers' association to be accredited as seed growers and provide facilities like cold stores, protected cultivation, improved laboratory seed facilities like pest clinic, tissue culture and post-harvest laboratories, scale-up seed production technology through advance agriculture, SMART agriculture and enhance public-private partnership on seed production. These are goals of the recently approved Potato R&D Center project funded by the government particularly the Department of Science and Technology (DOST), through the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) and also Department of Agriculture-Bureau of Research for the piloting or commercialization of the improved seed technologies.

Do you think that the involvement of the private sector will increase production? Is it possible to get subsidy from the government?
The involvement of the private sector is very important. The government - Department of Agriculture-Cordillera Administrative Region (DA-CAR) previously granted one-unit greenhouse (200 sqm) each to fifteen potato farmers' association and six unit diffuse light seed storage (10 ton capacity), distributed rooted apical cuttings to start their seed production and various farm tools/equipment for seed production. Seed production trainings and workshops were also organized for farmers. However, there must be selected farmers' association to be accredited or certified to be seed producers to solely concentrate, expand and sustain seed production entrepreneurship.

Will it be possible for farmers to be subsidize through loans?
The DA had approved agricultural loans and crop insurance. Potato is one of the selected crops that is approved for crop insurance.

Do you have partnership with municipalities?
The Local Government Municipalities are partners in our agricultural extension activities. They assist in extension and monitoring of activities, recommend farmer partners, organize farmers for our extension activities.

Are there large private investors on seed production?

No large private investors, but a government agency, the Northern Mindanao Agricultural Research Center (NOMIARC), now Northern Mindanao Consortium for Agriculture, Aquatic and Natural Resources Research and Development (NOMCAARRD), of Malaybalay City Bukidnon had also invested on seed potato production for the Northern Mindanao after some of their research staff came to Benguet State University-NPRCRTC for a training on seed potato production. However, their production is not sufficient to meet the demand of potato farmers in their locality.

What are the gaps and challenges of the technology?

- Soil borne diseases like bacterial wilt is a problem, most especially in the warmer areas;
- Accreditation of potato seed growers to level-up the seed system so to expand market of the locally produced seed potato. This will encourage private entrepreneurs to invest and expand seed production;
- Lack of post-harvest facilities for seed especially cold storage that will delay dormancy and would allow to bulk store seed potato for the next planting season;
- Lack of varieties adapted to specific-location or specific season to help mitigate climate change;
- Limited market for fresh processing potato.

What is the informal seed system?

Informal seed system refers to farmers repeatedly saving a portion (usually 12% in the Philippines) of their seed from their harvest for the next growing season. The seed saved from the harvest can also come from other farmers, or neighbors or from agricultural trading post. Apical cutting technique is being gradually introduced to potato farmers to improve access to quality seed potato.

Mechanized zero-waste processing system for sweetpotato

Dr. Daniel Leslie S. Tan, *VSU Processing engineer* ***& Dr. Julie D. Tan, VSU*** *Food Technologist*

Brief description of the innovation and case presentation

A system for producing different products from sweetpotato roots, with the vacuum fried sweetpotato being the main product. The peels and irregular cuts are utilized as raw material for sweetpotato wine and sweetpotato flour. The key innovation is the development of the portable vacuum fryer which uses the ordinary water pump coupled with the water-jet ejector, instead of the expensive and high maintenance vacuum pump. Also, since it has no vacuum pump, it does not require a condenser. With this innovation, the cost of the machine is about half of the existing vacuum fryer in the local market, but its capacity is doubled.

Innovative features and relevance to climate change

Innovative features and relevance to climate change of the zero-waste processing system include: 1) the sweetpotato as raw material is naturally a climate resilient crop, and with the zero-waste system almost all of the sweetpotato roots are utilized for processing into different food and beverage products; 2) the portable vacuum fryer utilizes much less energy (about half of the existing vacuum fryer), and thus it has a lower carbon footprint; and 3) vacuum frying utilizes the oil at least 15 times in frying the products, and the used oil can be converted into biodiesel.

Questions from KLF participants

Is the machine already available in the market?
Not yet available but can be fabricated by Visayas State University if ordered.

Is the machine already patented?
The Portable Vacuum Fryer has a Utility Model granted.
Does the sweetpotato wine have patent?
Yes. As Utility Model.

What is the difference between the available vacuum fryer in the market and the portable vacuum fryer?
The vacuum generation system in the portable fryer is the main difference. Instead of the vacuum pump in the existing system, the portable vacuum fryer uses the water pump and the water jet ejector to generate the vacuum, resulting in much lower cost and double capacity.

What is the capacity of the portable vacuum fryer in one day?
It has a maximum capacity of 14 kg/batch per cylinder operating 3 cycles in a day.

Is the vine of the sweetpotato included in the zero-waste processing system?
Only the roots are included in the system. The vines are not included.

FBS and ABS: Innovations for farmer-fisherfolk entrepreneurship

Ms. Rhine Joy Lesigues, *BFAR-FishCORAL Institutions and Gender Specialist*
& Ms. Johanna San Pedro, *DENR-INREMP Operations Manager*

Brief description of the innovation and case presentation
Farmer Business School (FBS) is a participatory action learning approach to build the entrepreneurial capacities of farmer-fisherfolk groups to successfully participate in agricultural value chains. It is an innovation introduced by CIP through the FoodSTART+ project, adapted by INREMP and further adapted by FishCORAL into Aqua-based Business School (ABS). As part of the capacity strengthening, FBS and ABS are comprised of a series of group-based experiential learning activities over a production-marketing cycle while facilitating interaction among chain actors and stakeholders. Value chain analysis and guidance on entrepreneurship building is new to most of both projects' beneficiaries and staff.

The case presented by INREMP and FishCORAL focuses on the innovative features of the approach, lessons learned, and recommendations based on actual experiences of all stakeholders. especially the FBS/ABS facilitators and enrollees during the implementation of the approach.

Innovative features and relevance to climate change

- The FBS and ABS implementation is in partnership with FoodSTART+ who shares the same vision of providing additional livelihood to the rural communities;
- A learning process based on "out of the classroom" approach;
- Flexible curriculum; although FBS was originally design for RTCs, it can be also used for non-RTC products.

Most of the products from INREMP's FBS are RTC-based: studies conducted in the Philippines and in other Asian countries found that RTCs are more climate resilient than above-ground crops. With this, RTCs are considered as key contributors to food security and project's goal. FishCORAL supports activities of fishing communities and local government units to manage fishing efforts and provide alternative marine and land-based livelihood opportunities to contribute to the reduction in overfishing. The project found that RTCs are important crops for fisherfolks, particularly during the rainy season and at times of calamities. Most farmers and fisherfolks are not aware of the contribution of RTCs to climate change resilience since they are not fully informed or educated about what climate change is. The FBS and ABS do not only capacitate farmers and fisherfolks into becoming entrepreneurs but also expose and inform them on the risks of climate change and measures to mitigate its impact on their livelihoods.

Orange fleshed sweetpotato (OFSP) puree: Processing, product development and nutrition in Africa

Dr. Mukani Moyo, *CIP Food Scientist*

Brief description of the innovation and case presentation

Orange fleshed sweetpotato (OFSP) is a rich source of beta-carotene, a precursor for Vitamin A in the human body. In sub-Saharan Africa, consumers typically prepare freshly harvested roots by steaming, boiling, baking or frying. Unfortunately, the seasonality of fresh roots and their short shelf-life contribute to inconsistent market supplies and high post-harvest losses. CIP has addressed these problems by developing a vacuum-packed OFSP puree, which is steamed and mashed OFSP roots, that can be stored at ambient temperature (below 25°C) for up to three months. The puree can replace 20–60% of imported wheat flour in baked products such as bread, scones and cakes, ensuring that the vitamin A content in the final product is significantly increased. From a nutrition perspective, this contributes to the fight against Vitamin A deficiency, particularly in urban areas where there is a high demand for convenient, ready-to-eat nutritious foods. From a value chain perspective, the puree can ensure that consumers and processors have a steady supply of sweetpotato all year round; offers opportunities for inclusive business models engaging with small-scale farmers; and supports national import substitution strategies. Further research on developing puree that does not require any refrigeration and with no preservatives is on-going in collaboration with North Caroline State University and SinnovaTek.

Innovative features and relevance to climate change

Innovative features of the OFSP puree include:

- shelf-stability of vacuum-packed puree prepared with locally available preservatives which can be stored for up to three months without spoilage or loss of beta-carotene content;
- frozen puree which can be stored for up to one year;
- high-fibre puree – mashed roots with skin;
- on-going research on aseptically packed OFSP puree with no preservatives and no need for refrigeration.

In terms of relevance of OFSP puree to climate change, sweetpotato is a climate-smart crop. It can grow under diverse weather conditions including drought-prone areas and from sea level to 2400m in Sub Saharan Africa. The roots have been shown to adapt to diverse environments once

established. Some varieties are adapted to low altitude areas with sandy soils whilst some are more cold-tolerant. Reasonable yields are achieved without the use of inorganic fertilizers, an attribute appreciated by resource-poor farmers who cannot afford the costs of additional farm inputs.

Questions from KLF participants

Suggestions forwarded during the open forum:
The label on the puree should state the

- Preservatives used and quantities;
- Varieties of sweetpotato used to make the puree;
- General nutritional information such as energy and beta-carotene level.

School crop museums: Repositories of vanishing and underutilized genetic resources

Ms. Shiela S. Anunciado, *IIRR Agriculture Officer*

Brief description of the innovation and case presentation
The loss of agrobiodiversity is alarming given the increasing trend of undernutrition and obesity among children. The availability of diverse, nutritionally relevant, indigenous and locally adapted vegetables must be ensured. Schools are among the best platforms for conserving agrobiodiversity.

We are rapidly losing this diversity and once lost, we many never regain this important heritage. Schools can serve as custodians of our biodiversity heritage. IIRR has advocated such conservation for four decades. In the past six years, IIRR in the Philippines has supported the Department of Education in promoting the establishment of 520 school crop museums nationwide (every school division or municipality has one school crop museum).

School crop museums serve as conservatories, community seed banks and propagation sites for climate resilient, indigenous and locally adapted vegetables. These are further distributed by school teachers to other schools, to parents and community members via annual seed sharing events. School gardens can serve as a repository for our vanishing genetic resources heritage, the same way as a museum helps conserve artifacts. It is a venue on growing and saving crop diversity for future generations.

School partnerships to other CSOs, the private sector, and efforts to converge with other government agencies like Department of Agriculture is on-going and expected to benefit more schools and communities in the Philippines.

Innovative features and relevance to climate change
Some of the challenges of climate change might be addressed by relying on locally adapted crop cultivars. Agrobiodiversity ensures better resilience to damages caused by pests and extreme weather conditions. Indigenous and locally adapted crops are adapted to the local environment and can tolerate adverse weather conditions thus more resilient to climate change. We might

increasingly rely on these crops in the future when our climate has changed significantly. By educating and exposing children to gardening and food production, and nutrition, we are molding future stewards of the environment and practitioners of good health.

Questions from KLF participants

Is the education on nutrition, gardening, and agrobiodiversity conservation done at the same time?
Yes. Education is integral if we want a behavioral change.

How much would it cost to establish a crop museum?
2,000 USD for the materials and trainings.

Are you only focused on indigenous vegetables?
No, we have mixed cropping. A proportion of 70:30 indigenous/locally adapted crops and exotic crops for a more resilient farming system.

How are the parents involved?
School crop museums served as nursery for local crops. These are propagated and distributed to parents accompanied by few sessions of gardening, cooking preparation, and basic nutrition education. In this way, we have evidence that gardening and preparation of nutritious food are extended on their homes.

If you were to scale to other countries, what do you think is needed or should be in place?
Capacity training and resources (human and financial). It's a good thing that in the Philippines, we have support policies on school gardens and nutrition that can pave way to this innovation.

Triple climate-resilient cassava-cowpea intercrop practice in Northern Vietnam

Mr. Vu Thanh Bien, *VNUA Scientist*

Brief description of the innovation and case presentation
Monocropping and crop intensification to meet food security and market needs have quickly driven Northern Vietnam's upland agriculture towards soil degradation and unsustainability over the last few decades, especially under extreme climate impacts. As soil nutrients became gradually depleted, farming systems have been shifted towards crops that require less, i.e. from upland rice to maize and eventually cassava. Van Yen district of Yen Bai province has followed this path of Northern Vietnam's farming history. Soils have been exhaustedly exploited and now its fertility and quality need to be restored for future generations. Since 2016, the CCAFS program in collaboration with a research team from Vietnam National University of Agriculture (VNUA) has introduced an intercrop system that combines leguminous cowpea and cassava. This serves as a climate-smart practice to help improve adaptive capacity and resilience of Van Yen farmers in the changing climate nowadays. Up until today, farmers have well received the practice and adoption rate has slowly increased within the community. Field experiment data have proven the triple win hypothesis of the research team and will be soon published.

Innovative features and relevance to climate change

The research has addressed the two pillars under the CCAFS program, based on research data of two years 2017 and 2018, including:

- Adaptation: Population densities of red spider mites are higher in monocrop than intercropped fields.
- Adaptation: Soil quality in intercropped plots is higher than in control plots (identical baseline before cowpea was introduced).
- Food security: Cassava yields are higher in the intercrop than the monocrop system, besides the additional income from cowpea.

Questions from KLF participants

What's the reason for the higher yield?

When applying cowpea, the soil improves (moisture, organic carbon) and leads to increase yield; lower population of red mite.

What are the soil fertility parameters used in the study?

Three parameters: organic carbon, nitrogen, humidity (not considering others like pH).

What are the challenges encountered in applying the technology?

People in the study site are mainly ethnic minority, change of perspective is difficult; more time to convince to adopt the intercropping method.

What are the other crops for intercropping with cassava, especially in the Philippines?

Mungbean

Why focus on red mites?

Big population of red mites; higher during the hot season.

What are the factors contributing to decrease in red mites?

Increase soil humidity leads to decrease red mite population.

Did you apply fertilizer application for cowpea?

We applied some.

Do you practice weeding for monocrop plots?

When cowpea is growing, no weeding for the intercrop.

Introducing and scaling agricultural innovations through IFAD grant-loan Partnerships

Dr. Diego Naziri, *CIP FoodSTART+ Coordinator*

Brief description of the innovation and case presentation

The IFAD/EU funded grant project FoodSTART+ aims to enhance agri-food system resilience among poor households in upland and coastal communities of the Asia-Pacific region, through introducing RTC innovations, primarily within the framework of IFAD investment projects.

Implemented by CIP and partners, over the last four years, FoodSTART+ has identified, tested and promoted a number of technologies and approaches to improve production and post-harvest management of RTCs in target sites of investment projects. These span from varieties to seed multiplication techniques, climate-smart agronomic practices, storage technologies, processing methods, and product and value chain development among others.

One of the main institutional innovations of FoodSTART+ is the collaborative implementation approach with IFAD investments whereby innovations and project activities are jointly identified, implemented and funded, and relevant capacities of IFAD partner investments built in order to take the validated innovations to scale.

Innovative features and relevance to climate change

FoodSTART+ established different kinds of partnerships with five IFAD investment projects in Asia: Megha-LAMP in India, SOLID in Indonesia, FishCORAL and INREMP in the Philippines, and SRDP-Quang Binh in Vietnam. These IFAD partner investments are expected to achieve impact at scale in part through using FoodSTART+ innovations. FoodSTART+ contribution is particularly relevant to investment's goals related to income generation, diversification and resilience, the latter particularly amidst climate change.

The grant-investment partnerships as a model for ensuring wider uptake, sustainability and scalability of high potential technologies and methodologies builds on the strengths of each partner organization and is showing promising results. However, establishing and maintaining such kind of partnerships requires considerable time and effort. This entails mutual understanding and alignment of goals and differing demands of the partners, and recognition of the limitations and constraints faced by each. The step-wise approach adopted by FoodSTART+ for successfully collaborating with large-scale development-oriented investment projects case was presented and discussed. Facilitating factors and challenges were also highlighted.

Questions from KLF participants

What are the technical innovations introduced through FBS?

This depended on the specific context and market opportunities targeted by the FBS group. Technical innovations ranged from new varieties, to multiplication of healthy planting material, climate smart agricultural practices, food and feed processing techniques (particularly for sweetpotato and cassava). Most of them were introduced in the framework of FBS

Why alignment from grant and investment project's cycle is so important?

Based on our experience, engaging with investment projects in the first year is challenging as the focus is on planning and procurement with limited implementation of activities. On the other hand, establishing a partnership in the last 2-3 years of the investment cycle is not ideal as the staff of the implementing agencies is often under pressure to finalize the implementation of already planned activities and is unwilling to add more on their plate. Furthermore, the time left for scaling the innovations would be limited.

How does this partnership model work if we want to establish a collaboration between CIP and my research institute in Myanmar?

FoodSTART+ fosters research-development partnerships around an IFAD research grant and IFAD investment projects. In doing so we also try to engage and mobilize available national research partners. Therefore, we can engage with your research institute in the framework of a future partnership with IFAD investments in Myanmar, such as with ESAP and WSAP projects. But this is only one of the many venues for establishing collaborations between research organizations and CIP would be happy to discuss this further with you.

DAY 2: OCTOBER 18

Master of Ceremonies: Dr. Lilian Bondoc, *DOST-PCAARRD*

I. DAY 1 SYNTHESIS

Dr. Gordon Prain, *CIP FoodSTART+ Technical Advisor*

Dr. Prain reiterated the message of Secretary Dar: strengthening the position of Philippines in ASEAN is challenging, particularly in seed production of RTC. There is a need to disaggregate the issue of resilience. Issue on how to encourage farmers to take up these crops? Is the world basically conservative or innovative? The answer is both, but we need to find ways to encourage innovation and find leverage point to overcome unwillingness to change. Many issues discussing in Day 1 focused on demand and market. Changing perceptions about RTCs. There have been some evidences of perception changes in Vietnam, East Asian, even UK. Finally, Dr. Prain thanked the organizers for the rolling caravans from moving stalls during the KLF, it was very well organized and it is easy to take advantage of the presentations of different booths. Congratulated the presenters and organizers. The mini-workshop sessions were very facilitative.

II. GROUP REPORTING ON CASE ASSESSMENT

Facilitator: Dr. Diego Naziri, *CIP FoodSTART+ Coordinator*

Seven groups were formed to report on their observations about the innovation cases presented in the KLF. One group was assigned per KLF case. They focused on the following questions for their assessment:

1. What are the good practices and elements of success of RTC innovations?
2. What are the gaps and challenges?
3. What conditions are needed for scaling up the innovations?

Production of clean planting materials to address sweetpotato viruses and other pests in Central Luzon, Philippines &
Rooted apical cutting technique for the production of quality planting material of potato: The Cordillera Administrative Region (CAR) Philippines experience

Ms. Virginia Agcopra, *FAO National Project Coordinator (Philippines)*

Good practices: disease free planting materials were made available; trainings provided to farmers about the technology; farmers become planting materials producers; the seed producers were assisted in detecting viruses through assay, BPI does the certification.

Elements of success: increase in yield, adoption by farmers, creation of seed/planting materials enterprise and livelihood, possible replication of the technology to other producing areas.

Gaps and challenges: presence of soil-borne diseases in the farmers' field; limited area in Cordillera specifically Benguet to meet the demands of the planting materials, only a few private investors adopt the technology.

Conditions and partnerships needed for scaling up: need support to farmers producing planting materials, mapping of disease-free growing areas, accreditation of nurseries and certification of planting materials.

Mechanized zero-waste processing system for sweetpotato

Ms. Rosario Bantayan, *SEARCA*

Good practices: zero-waste processing system, high value added, increase energy efficiency – lower carbon footprint, reuse of oil at least 15 times in frying the chips; used oil can be converted into biodiesel.

Elements of success: functional characteristics of the food (e.g., low glycemic index, high in vitamin and minerals and antioxidant properties), highly recommended as nutritional snack for young and old, potential for upscaling and application of processing systems for other crops (other fruits and vegetables), potential as alternative for high glycemic products such as potato French fries, rice, etc.

Gaps and challenges: consistent supply of sweetpotato (e.g., increase productivity, availability of areas suitable for production, government prioritization), high cost of packaging to make the price competitive, social entrepreneurship, changing consumer perception about sweetpotato (increase awareness of nutritional benefits and removing the notion that it is a poor man's food), information and educational campaign on functionality of sweetpotato, drumming up of promotional programs/strategies, introducing sweetpotato as part of our staple diet (recapturing our own culture), lowering the cost of production to make the price competitive.

Conditions and partnerships needed for scaling up: able to present to other Asian countries stories as evidence of success, need to "walk the talk" before we venture out to other countries.

FBS and ABS: Innovations for farmer-fisherfolk entrepreneurship

Ms. Bernice Ann Darvin, *SEARCA Program Specialist*

Good practices: creation of an aqua-based learning platform, integration of entrepreneurship in the modules, flexible class schedules, use of local languages/dialects for its learning materials, tailor-fitted teaching methods.

Elements of success: FBS is already being implemented by other countries such as India and Indonesia, it is recommended to scale up within these countries before going regional; a good

potential for diversification of livelihoods, use of value adding features or incentives like "badging" to encourage more participation.

Gaps and challenges: cultural differences, varying profiles of potential beneficiaries, ensuring that the beneficiaries will be committed to finish the course, high turnover rate of facilitators (short contracts – six months), hesitance of farmers/fisherfolks to enroll without immediate visible results/gains; engaging LGUs i.e., extension workers and capacitating them.

Conditions and partnerships needed for scaling up: strong government (national and local) support, partner with relevant agencies with similar objectives/focus (i.e., FO/CSOs, research/international organizations, academe).

Orange fleshed sweetpotato (OFSP) puree: Processing, product development and nutrition in Africa

***Haryanti Koostanto**, CIAT Research Assistant*

Good practices: the raw materials are biofortified and affordable; product is accepted by consumers because of its benefits; it addresses malnutrition such as Vit. A deficiency and obesity; products have an established market; processing creates employment opportunities.

Gaps and challenges: seasonality of the roots – inconsistent supply; few adopters; limited use of puree in informal markets' vendors; and development of cost-effective aseptic packaging.

Conditions and partnerships needed for scaling up: increase production of raw material (OFSP); need to develop new products based on OFSP; studies of economic viability and of the impact of substituting wheat flour with OFSP over importation of wheat are recommended; policy on utilization of OFSP puree to address malnutrition is advisable; and development of IEC materials to raise the awareness of consumers on the benefits of OFSP puree is also needed.

School crop museums: Repositories of vanishing and underutilized genetic resources

***Mr. Soane Patolo,** Project Manager on TRIP II (Tonga)*

Good practices: promotion of indigenous vegetables; development of indigenous vegetables recipe booklet; engagement of stakeholders; nutrition education; and seed saving and exchange.

Elements of success: adapted to other countries; availability of generated data to support fund sourcing; interest expressed by WFP Laos PDR, China, Vietnam; lobbying to multi-lateral funding agencies for investment.

Gaps and challenges: testing of the model is too slow due to lack of enabling policy on school gardening and nutrition; the need for capacity building in establishing crop museums.

Conditions and partnerships needed for scaling up: enabling environment is key to successfully implement the project supported by policy guidelines; partnership between the stakeholders and adopters (parents, schools, and various government agencies); resources

(funding, capacity building, human resources); consider localization of the approach/design for ease of adoption.

Triple climate-resilient cassava-cowpea intercrop practice in Northern Vietnam

Mr. Vu Thanh Bien, *VNUA Scientist*

Good practices: intercropping of cassava and cowpea contributed to lower population densities of red mites; enhanced organic carbon, nitrogen and soil humidity; food security (cassava yields higher in intercrop); farmers doubled their income.

Elements of success: Cassava is more tolerant to low soil fertility hence it is suitable for soil degraded lands; the innovation does not require much investment; large internal market; the innovation is a promising climate-smart practice promoted by the CCAPS program.

Gaps and challenges: low and unstable price; unknown origin of the seed can affect production.

Conditions and partnerships needed for scaling up: there is a need to find stable and lucrative markets for cassava and cowpea products; there is also need for investment on the improvement of farm to market roads and infrastructures; strengthening the linkage between research and extension; strengthened breeding programs for cassava an cowpea; partnerships between private and public institutions to improve the cassava sector.

Introducing and scaling agricultural innovations through IFAD grant-loan Partnerships

Ms. Angelee Ramal*, FAO National Program Development and Management Associate*

Good practices: structured (stepwise) approach to establish and maintain partnership; flexibility of the grant design to adapt to the needs of the partners for further collaboration; identifying innovation/technology that fit the needs of the investment or can be adapted; searching for the match or "fit" of what development investments need and research organizations can offer; activities jointly planned, implemented and funded; initial consultation with government agencies implementing the investment; locating staff in/close to the national agencies implementing the investments; continuous monitoring of the partnership efficiency.

Elements of success: developing countries need innovation for sustainable development, IFAD and national government funding are available for agriculture development but research support is needed to introduce, adapt and deploy the innovation. There is considerable funding for research, but researchers are facing challenges on how to bring innovation to use at scale.

Gaps and challenges: reluctance of national agencies to change their behaviors and sometimes negative perception of what research can offer; bureaucracy limits the flexibility of national agencies to implement innovations; staff of national agencies are overloaded by existing activities.

Conditions and partnerships needed for scaling up: capacity building of the implementing agencies; confidence building around research development partnership model; brokerage of

IFAD country offices are key to facilitate the engagement; synchronization of grant and loan during project cycles; grants with longer implementation period is preferred; identify adaptable innovations that are ready/almost ready for deployment (e.g., OFSP puree).

III. ROUNDTABLE DISCUSSION 1 (RESEARCH, FAMERS, AND PRIVATE SECTOR PERSPECTIVES)

Moderator: Mr. Jing Pacturan, *IFAD Philippines Country Programme Officer*

Discussants:

Dr. Samarendu Mohanty, *CIP Regional Director for Asia*
Dr. Anantharaman, *FoodSTART+ Technical Advisory Pool Member*
Dr. Julieta Roa, *FoodSTART+ Technical Advisory Pool Member*
Dr. Julian Gonsalves, *IIRR Senior Advisor and FoodSTART+ Technical Advisory Pool Member*
Engr. Vergel Abrenica, *San Miguel Foods Corp. Operations Analyst*
Mr. Ferdie Buenviaje, *MTCP2 Project National Coordinator*
Ms. Elizabeth Timblaco, *Member of BOD Livelihood, SCARED/INREMP, Philippines*

Questions

What are the major challenges or disincentives that you face for enhancing and expanding the production, processing, and utilization of RTCs?

Engr. Abrenica: We are working on cassava and partly sweetpotato for our feeds business. Almost all year round, we experience weevil infestation. Another challenge is the need for yield improvement in Cagayan Valley.

Mr. Buenviaje: The challenge is to ensure that farmers decide on crop production in a more informed (smarter) fashion. There is a need for climate-resilient varieties that would be very useful if mainstreamed or made available to farmers through extension. Another challenge is on how we ensure that the farmers are given information and that extension strategies are well implemented. Another concern is the limited access to good practice and models for agribusiness ventures. One more challenge is the limited popularization of the diverse uses of RTCs (e.g., functional products) that will make these crops more appealing to farmers.

Ms. Timblaco: There are a lot of problems in our area but through the INREMP project funded by IFAD, we were provided with good quality planting materials and GAPs. After which we observed increase in productivity. Now we are also into processing which increased our income. The key challenge for now is financing because the planting materials is from our own finances. Another is the weevil control.

Does any of the innovations presented and discussed in these two days have potential for addressing these challenges?

Engr. Abrenica: Based on the shared parameters and protocols, the climate-smart practices from Vietnam's are promising. In Isabela, there is very poor planting material vigor and sometimes farmers would not even harvest due to very low yields attributed to extreme wet followed by extreme drought climate.

Mr. Buenviaje: The Geospatial mapping of the future of cereal and RTC farming. Farmers said that suitability maps are available at the municipality level. Important to have very location-specific information on these so that farmers will be given more appropriate information that can guide them in their decisions.

According to you, what other innovations should be prioritized*?*

Engr. Abrenica: Harvesting and postharvest technologies.

Some of the challenges we have heard are likely to be relevant also to other countries in Asia. What is the role and contribution that you envision for research, and possibly for your institute, to help address the needs that have been indicated by the representatives of farmer organizations and private sector who eventually are our ultimate clients? What partnerships or collaborations should be in place to do that effectively?

Dr. Roa: "If you don't change the ways, your research won't go anywhere" – learned from a director of an international agency. Institutional innovations in the Philippine research and academic institutions are needed for ensuring that new technologies are adopted by farmers and linking them to market. Community level engagements and strengthening partnership with NGOs, other GOs, and international partners have been done by VSU toward this cause.

Dr. Gonsalves: I think that the issue of socially inclusive local seed systems is a very important point that need to be emphasized. All seed systems should be pro-poor and socially inclusive.

Dr. Anantharaman: There are technologies in place to manage sweetpotato weevil. One is Integrated Pest Management which is a package of control technologies which include six pillars: sex pheromones system; long-neck varieties which are less susceptible; varieties with suitable duration of the cycle; reduced infection; selection of planting materials free from weevil infestation; and treatment of planting materials before planting. On drying system, there are ready technologies on this that the private sector can pick up and buy-in. Agribusiness innovation centers attached to research institutions are in place in India. They not only teach the technologies but also how business is done (technology incubation). On finance issues, in India we have a system of cooperative methods and financing institutions.

Dr. Mohanty: There is declining demand for sweetpotato, the production areas are also declining. When farmers are asked, the key cause is financing because production is costly (especially on potato); second is inefficient market linkages. There is bias on policies for cereals. What we can do in CIP? Our innovation should be demand-driven (based on what is needed by the users). Historically, varieties are being breed mainly from the point of view of the scientists and not by the end users which cause low adoption/buy-in by farmers. This has recently changed to make research more responsive to the needs and preferences of farmers and consumers.

To what extent do you work with Tarlac Agricultural University (TAU) and Philrootcrops? Is there any partnership?

Engr. Abrenica: We have collaborated with Philrootcrops. We have actually a consultant from Philrootcrops.

Mr. Buenviaje: There is a weak connection with information/technology sources to the farmers. There is a need to package information materials that would be very beneficial and interesting to

the farmers. Farmers should also be part of the knowledge creation process. Community-based systems were implemented before for rice with IRRI but there is none yet for RTCs.

Dr. Gonsalves: We need more decentralized seed systems (emphasized!). This has been the way for many countries which made them more self-sufficient. You may have a consumer demand but what are the incentives for farmers to produce that if they do not have the financial capital. There should be sustained social local financing to ensure both scaling and sustainability. We need segmented approaches to different audiences (e.g., geographic targeting, social targeting).

Dr. Roa: Reiterated the importance of institutional changes and innovations. Coming up with technologies that would be most beneficial to the end-users, addressing their needs.

Ms. Timblaco: DOST provided us with some equipment while LGU provided some capital. We are afraid to borrow from financial institutions.

IV. ROUNDTABLE DISCUSSION 2 (GOVERNMENT AND DONOR PERSPECTIVES)

Moderator: Dr. Erlinda Vasquez, *VSU-PhilRootcrops Director*

Discussants:

Dr. Fabrizio Bresciani, *IFAD Regional Economist for Asia*
Ms. Virginia Agcopra, *FAO National Project Coordinator (Philippines)*
Mr. R.K Nithanga, *State Project Director for FOCUS (India)*
Mr. Hoang Van Giap, *Project Director for CSSP-Bac Kan Province (Vietnam)*
Interpreter: Mr. Nguyen Thanh Tung, *IFAD Country Programme Officer (Vietnam)*
Mr. Seng Hkum, *Project Management Advisor for ESAP (Myanmar)*
Mr. Soane Patolo, *Project Manager on TRIP II (Tonga)*

Questions

What are the major lessons and take-home messages from these two days? What is the contribution that innovation around RTCs can make to the mandate of your organization and, more specifically, to the success of implemented initiatives linked to climate change and in relation to IFAD-supported investments? What is needed to make it happen at larger scale?

Mr Nithanga: RTCs are not yet included as primary crops in FOCUS-Mizoram. I have requested my team to survey our areas as potential growing areas for RTCs. They have identified 20 areas with farmers cultivating RTCs. The problem of our farmers is planting material. CIP and FoodSTART+ are working hard on RTCs. A tissue culture lab would contribute very much to our project and target farmers.

Mr. Van Giap: This congress made me realize there are so many opportunities in the production of RTCs. The knowledge shared in this congress such as on seed production, marketing, product development will be very helpful to our farmers. I also learned that the contribution of our researchers must be disseminated to and put into use by the actors of the value chain. I have learned by many agencies supported by international organizations that there are many innovations. It is important now to promote partnership between researchers, public and private institutions. I think the main challenge is how to link the technologies to the users. If we have

support, we need to establish and/or institutionalize partnerships among diverse stakeholders in order to help our farmers.

Mr. Hkum: The challenge of climate change is quite serious, including in Myanmar. Here we need to gain the confidence of the local populations because most of them, particularly in post-conflict areas, don't trust the government. Formulating project activities and interventions can be challenging. Targets should be clear; otherwise, it will be useless and peace can be ruined. We have RTCs, however they are neglected due to very poor awareness on their benefits. Promoting these neglected crops is quite important because they have good potential to enhance resilience. Myanmar have 54M population and all the opportunities are there. If these technologies will be disseminated to our farmers, they will have an impact.

Mr. Patolo: We are one of the Asia Pacific countries which are targeted by IFAD (through the TRIPII project). From what I have learned, expansion of network is important and now I have managed to know many agencies which are engaged in RTCs. In the pacific, the impact of climate change can be already seen. The various innovations I have been made aware in these two days would be very useful to my country. We need more cross-learning among nations to explore scaling up. To learn it here and bring it home is something potentially highly beneficial to our farmers.

What are the major lessons and take-home messages from this Congress? What needs to be done and what are the main recommendations for enhancing the contribution to RTCs to agri-food system resilience in the face of climate change, income generation, job creation, and gender equity in the region? What opportunities exist to build on and complement ongoing initiatives funded or implemented by your organization?

Dr. Bresciani: There were a lot interesting concepts. Something that really struck me was the work that has been presented as to how climate change is projected to affect crop suitability. The trade-offs can be quite serious. Many areas planted with rice and corn can become more suitable to RTCs in the near future. Research has the potential to contribute addressing climate change, although there are many challenges and it may take a long time to develop a technology. In terms of policies and potential to enhance market linkages for RTCs, it was interesting to see the point of view to CIP. Donors may be able to support these linkages and partnerships between public and private institutions. Furthermore, aid agencies, including for instance IFAD and the World Bank are increasingly focusing on agri-food systems to address nutrition. This is a timely moment for RTCs, because these crops have a high nutritional value. However, all opportunities, including for RTCs, are location specific.

Ms. Agcopra: What we need is to throw these innovations to the adapters. We need to bridge this gap. We need to involve policy makers. We need to come up with a tagline and identify champions. We can use social media to disseminate RTCs technologies and promote RTC-based enterprises. We need to target the indigenous people because they are the custodians of germplasm that can be valuable for breeding for resilience. As areas of complementation, we can introduce these technologies to farmers by capacitating them and enhancing their participation in value chains as producers, manufacturers and sellers.

V. CLOSING PROGRAM

Synthesis and way forward

Dr. Diego Naziri, *CIP FoodSTART+ Coordinator*

Dr. Diego Naziri provided the synthesis of the congress. He mentioned that the congress contributed to shed light on the current and projected contribution of RTCs to food/nutrition security and resilience to climate change in Asia. In particular, RTCs have been recognized as:

- Key crops for food security, particularly in poorest areas in Asia
- Mainstay of livelihoods for communities in marginal lands and indigenous people
- Able to grow in poor soils and with minimum input
- Nutrient-rich crops with on-going CGIAR effort in biofortification offering potential for further enhancing their role in tackling malnutrition. Also responding to urbanization and increasing attention to healthier diets (low glycemic index and gluten-free)
- Crops with potential for enhancing gender equity and inclusiveness of value chains (e.g. FBS/ABS experiences)
- Raw material for large-scale industrial processing and SMEs (particularly cassava in southeastern Asia) with potential for youth employment.
- Resilient to both long-term effect of climate change and increasingly frequent related extreme weather events, such as typhoons. Given their role in Asia, they contribute to the resilience of entire agri-good systems and their importance is projected to increase even further in face of the dramatic change in climate in the region.

The congress was an excellent venue for knowledge sharing and exploring opportunities for matching what research has to offer in terms of innovations and what are the most urgent needs by farmers, private sector and governments. In particular, research organizations presented their innovations such as new varieties (climate-resilient, resistant to increasing biotic and abiotic stress, and biofortified), seed production and delivery, agronomic and postharvest practices, product development, and partnership models. The KLF allowed to share different perspectives on relevant good practices, gaps and challenges, potential for replication/scaling, and partnerships needed for scaling (including enabling policies). During the roundtable discussions, farmer and private sector representatives indicated some of their key challenges which should be prioritized by research and/or dissemination of already existing innovations. These include limited access to high yielding varieties, lack of knowledge about innovative farming practices and decision support tools, increasing pest pressure, inconsistent supply of raw material for processing, harvest and postharvest challenges (including shortage of labor), need for innovative and inclusive agribusiness models. Representatives of national agencies implementing IFAD investments emphasized the importance of RTCs in their project sites and expressed a clear demand for relevant technologies and innovative approaches that can help them achieve their objectives, in particular in terms of support needed for enhancing local seed systems and filling increasing gaps from weakening extension and other public advisory services. Dr. Naziri then stressed on the importance of rethinking the research agendas for addressing these challenges, and on the need for establishing partnerships which build on the strengths and capacities of the different partners as done, for instance, through FBS (acting as catalyst for already available technical, business and financial services) or, more broadly, through the FoodSTART+ model that

has facilitated the introduction and adoption of innovations at scale through research-development partnerships. Based on the feedback from the partner IFAD investments, this model is worth replication. Finally, as a way forward, Dr. Naziri mentioned the upcoming proceedings of the congress to be shared with all participants, the inclusion of key-messages and recommendations in FoodSTART+ completion report, and the continuing exploration of opportunities for further engagement with IFAD investment projects in Asia for putting research into use and taking innovations at scale. He also indicated that CIP would always welcome ideas and suggestions for establishing collaborations around introducing, testing, validating and disseminating RTC innovations.

Closing Message

Dr. Fabrizio Bresciani, *IFAD Regional Economist for Asia*

On behalf of IFAD, Dr. Fabrizio Bresciani (IFAD) thanked the organizers of the congress which represented an excellent opportunity to learn more about the RTC sector and its recent advances. He also sincerely thanked the FoodSTART+ staff for managing such an effective project that is now considered a model within IFAD for implementing similar programs/grants. It was a wonderful opportunity for IFAD to fund basic and applied research, and support policy makers in the target countries. There is a desire to move the agenda on in recognition of the importance of R&D investments that benefit smallholder farmers and of the increasing role of RTCs in Asia. There is need to pay more attention to the untapped market opportunities for RTCs, their contribution to ensuring inclusiveness (women and youth) of value chain efforts, and on how to exploit the potential role of RTCs in facing emerging challenges, including agriculture structural transformation and climate change. Many of the themes presented during the congress were relevant to understanding the potential role of RTCs, how to move forward, and the opportunities for partnerships. This type of initiatives are of paramount importance for engaging policy makers and making the policy environment for RTCs more conducive. Dr. Bresciani concluded indicating that IFAD remains very much committed in continuing what started with FoodSTART+ but there is need to look at how we can upgrade this engagement by reflecting more on the issues presented over the last two days.

VI. FIELD VISIT

Facilitator: Dr. Julieta Roa, *FoodSTART+ Technical Advisory Pool Member*

Field visit's overview and instructions were presented by Dr. Julieta Roa. A total of 45 participants travelled to Pampanga for the field visit. Due to lack of time, all interactions took place at headquarters of Mekeni Food Corporation.

Mekeni Food Corporation: local meat processing company exporting cassava and sweetpotato to Japan

The participants were welcomed by Mekeni Food Corporation officials and staff led by Mr. Prudencio Garcia, President. A video presentation about the history of Mekeni was shown to explain the humble beginnings of the company which started as a backyard venture of former public school teachers - Felix and Meding Garcia. The Garcia's small family enterprise has now

become one of the leading food processing firms in the country. Mekeni is processing 50 tons of meat daily and started to venture in exporting fresh cassava and sweetpotato to Japan.

Cassava entrepreneur for local and export markets

Dr. Richard Torno, owner of the Torno Agro Enterprise is a veterinarian by profession. However, over time he has developed interest in root crops and their potential as a business. The company is currently involved in cassava production for local and export markets. Dr. Torno shared through a PowerPoint presentation the cassava production, technologies and varieties that they use for their enterprise. He also collaborates with the Mekeni Food Corporation as supplier of cassava for Japan.

Farmer/Indigenous Peoples Organization processing sweetpotato products

Ms. Ma. Concepcion "Maricon" Arcega, President of the Floridablanca-Lubao Organic Farmers Association, Inc. (FLOFA) shared about the work of their organization in root rops. The group is composed of farmer and indigenous peoples based in Sta. Cruz, Lubao Pampanga. FLOFA advocates organic farming and have various organic product including root crops. Products from sweetpotato includes chips, nuggets, and roti (flatbread). They also showed and discussed their Good Manufacturing Practices (GMP) compliant shared-service facility. The organization now plans to expand their operations and prepares to brace for the opportunities open for the development of Region 3 as the new economic zone. FLOFA sees this as an opportunity for massively increasing its local and tourist markets.

ANNEX 1. DIRECTORY OF PARTICIPANTS

A. Participants

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B. Media

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108	CAMBARA, Jimmy	Male	DOSTv, STII	Media (television/radio)	Quezon City	Philippines	
109	ICAMINA, Paul	Male	Malaya	Media (newspaper)	Manila	Philippines	
110	LIWANAG, Manolito	Male	SAKTO Balita, Diario Pilipinas	Media (newspaper)	Manila	Philippines	
111	MAYUGA, Jonathan	Male	Business Mirror	Media (newspaper)	Manila	Philippines	
112	MONDAR, Romulo	Male	DOSTv, STII	Media (television/radio)	Bicutan City	Philippines	
113	REMPILLO, Donalyn	Female	DOSTv, STII	Media (television/radio)	Quezon City	Philippines	
114	RICO, Raffy	Male	DOSTv, STII	Media (television/radio)	Bicutan City	Philippines	
115	SURARA, Annabelle	Female	Radyo Agila, DZEC 1062	Media (radio)	Manila	Philippines	

ANNEX 2. PROGRAM

Date	Time	Activity	Responsible/Resource
16 Oct.	Afternoon	***Arrival/Early Registration/ Hotel Accommodation***	Secretariat
		Ingress of the Knowledge Learning Fair	KLF Exhibitors
Day 1: 17 Oct.	08:00-08:30	***Registration***	Secretariat
		Opening Program	
	08:30-09:00	Opening Remarks by IFAD	Mr. Jing Pacturan, IFAD
		Welcome Remarks by CIP	Dr. Sam Mohanty, CIP
		Welcome Remarks by PCAARRD	Dr. Edwin Villar, PCAARRD
	09:00-09:15	Keynote address: The role of RTCs for food security and climate change resilience in the Philippines	Dr. William Dar Secretary of the Department of Agriculture By Undersecretary Cheryl Marie Natividad-Caballero
	09:15-09:30	Introduction to congress and orientation	Dr. Diego Naziri, CIP
	09:30-10:10	**Session 1: Key Experts' Presentations**	
		Climate-smart breeding: Experiences from the CGIAR Research program on Roots, Tubers and Bananas (RTB)	Dr. Neeraj Sharma, CIP
		Management options for cassava production systems under variable climate scenario	Dr. Imran Malik, CIAT
	10:10-10:30	Open forum	Moderator: Dr. Diego Naziri, CIP
	10:30-11:10	***Photo Session***	Secretariat
		Coffee Break	
	11:10-12:00	**Session 2: FoodSTART+ Experts' Presentations**	
		Contribution of RTCs to climate change resilience in India and the Philippines	Dr. Gordon Prain, FoodSTART+
		Modelling the future contribution of RTCs to resilient agri-food systems in Asia amidst climate change	Mr. Leo Palao, CIAT
		RTCs for reduced vulnerability to climate-related shocks: The case of super typhoon Ompong in the Philippines	Dr. Christophe Bene, CIAT
	12:00-12:15	Open forum	Moderator: Dr. Diego Naziri, CIP
	12:15-13:30	**Lunch Break**	
	13:30-13:45	***Video***	Secretariat
		Overview of the Field Visits and Instructions	Secretariat
		Session 3: Selected cases on RTC innovations and technologies	
	13:45-14:00	Introduction to Session 3: Overview and Learning Process	Dr. Diego Naziri, CIP KLF participants (pitch)
	14:00-14:10	***Opening of the Knowledge and Learning Fair (KLF)***	IFAD, EU, CIP, PCAARRD, VSU Distinguished guests
	14:10-15:20	***Round 1: Case Presentations***	Case presenters (in 8 booths): • International Potato Center (CIP) • FoodSTART+ • CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

			• BFAR-FishCORAL/DENR-INREMP • Visayas State University-PCAARRD • Tarlac Agricultural University • Benguet State University • International Institute of Rural Reconstruction (IIRR) All participants (each attending 3 cases)
	15:20-16:00	**Coffee Break**	
	16:00-17:00	***Round 2: Break Out Groups*** *Guide questions:* • What are the good practices and elements of success of RTC innovations? • What are the gaps and challenges? • What conditions are needed for scaling up the innovations?	Group facilitators (1 per booth)
	17:00-19:30	***Viewing of KLF and Participants' Interaction: Building Contacts and Collaboration***	
	19:30-	**Solidarity Dinner**	
Day 2: 18 Oct.	08:30-08:40	***Synthesis of Day 1***	Dr. Gordon Prain, FoodSTART+
	08:40-09:40	***Round 3: Reporting from Groups***	Group rapporteurs
	09:40-10:20	**Session 4: Roundtable discussion 1 (research, farmers and private sector perspectives)** Selected participants discuss RTC gaps, challenges and opportunities for collaborations	Participants from research organizations, farmers organizations and private sector Moderator: Mr. Jing Pacturan, IFAD
	10:20-10:50	**Coffee Break**	
	10:50-11:20	**Session 5: Roundtable discussion 2 (government and donor perspectives)** Selected participants discuss RTC gaps, challenges and opportunities for collaborations	Participants from government agencies and donors Moderator: Dr. Erlinda Vasquez, PhilRootcrops, VSU
	11:20-11:35	**Synthesis and Way Forward**	Dr. Diego Naziri, CIP
	11:35-11:45	**Closing of Congress**	Dr. Fabrizio Bresciani, IFAD
	11:45-12:30	**Lunch Break**	
	12:30-14:00	Travel to Pampanga	Secretariat
	14:00-17:30	**Field Visits in Pampanga** • Mekeni (local meat processing company exporting cassava and sweetpotato to Japan) • Cassava entrepreneur for local and export markets • Farmer/Indigenous Peoples Organization processing sweetpotato products	Dr. Julieta Roa, FoodSTART+
	17:30-19:30	Travel Back	Secretariat
19 Oct.	Departure of Participants		

Emcee: Dr. LiLian G. Bondoc, PCAARRD

ANNEX 3. PRESENTATIONS

Presentations	Presenter	Link
Welcome Remarks by CIP	Dr. Sam Mohanty, CIP	See link
Keynote address: The role of RTCs for food security and climate change resilience in the Philippines	Dr. William Dar Secretary of the Department of Agriculture By Undersecretary Cheryl Marie Natividad-Caballero	See link
Introduction to congress and orientation	Dr. Diego Naziri, CIP	See link
Session 1: Key Experts' Presentations		
Climate-smart breeding: Experiences from the CGIAR Research program on Roots, Tubers and Bananas (RTB)	Dr. Neeraj Sharma, CIP	See link
Management options for cassava production systems under variable climate scenario	Dr. Imran Malik, CIAT	See link
Session 2: FoodSTART+ Experts' Presentations		
Contribution of RTCs to climate change resilience in India and the Philippines	Dr. Gordon Prain, FoodSTART+	See link
Modelling the future contribution of RTCs to resilient agri-food systems in Asia amidst climate change	Mr. Leo Palao, CIAT	See link
RTCs for reduced vulnerability to climate-related shocks: The case of super typhoon Ompong in the Philippines	Dr. Christophe Bene, CIAT	See link
Session 3: Selected cases on RTC innovations and technologies (round 1)		
A climate-smart cowpea-cassava intercrop system that provides triple wins on mitigation of red spider mite, restoration of degraded soils, and increase in local livelihoods of Northern Vietnam	Mr. Vu Thanh Bien (VNUA)	See link
Production of Clean Planting Materials to Address Sweetpotato Viruses and other Pests in Central Luzon, Philippines	Ms. Lilibeth B. Laranang (TAU)	See link
Rooted apical cutting technique for the production of quality planting materials of potato: The Cordillera Administrative Region (CAR) Philippines experience	Dr. Cynthia G. Kiswa (NPRCRTC)	See link
Introducing and scaling agricultural innovations through IFAD grant-loan partnerships	Dr. Diego Naziri (CIP)	See link
Mechanized Zero-waste Processing System for Sweetpotato	Dr. Daniel Leslie S. Tan & Dr. Julie D. Tan (VSU)	See link
FBS and ABS: Innovations for Farmer-fisherfolk entrepreneurship	Ms. Rhine Joy Lesigues (BFAR) & Ms. Johanna San Pedro (DENR)	See link
School Crop Museums	Ms. Shiela S. Anunciado (IIRR)	See link
Orange fleshed sweetpotato (OFSP) puree: Processing, product development and nutrition in Africa	Dr. Mukani Moyo (CIP)	See link
Session 3: Selected cases on RTC innovations and technologies (round 3)		
A climate-smart cowpea-cassava intercrop system that provides triple wins on mitigation of red spider mite, restoration of degraded soils, and increase in local livelihoods of Northern Vietnam	Mr. Vu Thanh Bien (VNUA)	See link

Introducing and scaling agricultural innovations through IFAD grant-loan partnerships	Ms. Angelee Ramal (FAO)	See link
Mechanized Zero-waste Processing System for Sweetpotato	Ms. Rosario Bantayan (SEARCA)	See link
FBS and ABS: Innovations for Farmer-fisherfolk entrepreneurship	Ms. Bernice Ann Darvin (SEARCA)	See link
School Crop Museums	Mr. Soane Patolo (TRIP II)	See link
Orange fleshed sweetpotato (OFSP) puree: Processing, product development and nutrition in Africa	Ms. Haryanti Koostanto (CIAT)	See link
Production of Clean Planting Materials to Address Sweetpotato Viruses and other Pests in Central Luzon, Philippines and Rooted apical cutting technique for the production of quality planting materials of potato: The Cordillera Administrative Region (CAR) Philippines experience	Ms. Virginia Agcopra (FAO Philippines)	See link

ANNEX 4. PHOTO DOCUMENTATION

Mr. Jing Pacturan of IFAD (left) giving the opening remarks, and Undersecretary Cheryl Marie Natividad-Caballero of the Department of Agriculture (right) delivering the keynote address on behalf of Dr. William Dar, Secretary of DA.

Dr. Samarendu Mohanty of CIP (left) and Dr. Edwin Villar of DOST-PCAARRD (right) giving their welcome remarks during the opening program.

Dr. Imran Malik of CIAT (left) and (right) Dr. Neeraj Sharma of CIP (right) delivering the key experts' presentation.

Mr. Leo Palao, Dr. Gordon Prain and Dr. Christophe Bene during the open forum after their presentations as FoodSTART+ key experts (left). The opening of the Knowledge Learning Forum by representatives of CIP, IFAD and PCAARRD (right).

Roundtable discussions with research, farmers, private sector perspectives, government and funding donors.

Dr. Diego Naziri of CIP (left) providing the synthesis and way forward of the congress. Mr. Fabrizio Bresciani of IFAD (right) giving the closing remarks.

The presentations of 8 cases during the KLF. The presenters are BSU, TAU, INREMP and FishCORAL, IIRR, CIP, VNUA, VSU and FoodSTART+.

The field visit in Mekeni Food Corporation in Pampanga with FLOFA and Torno Agro Enterprises.